

Preventing the **N**ightmare

INSTITUTE OF GOVERNMENT
STUDIES LIBRARY

NOV 1999

UNIVERSITY OF CALIFORNIA

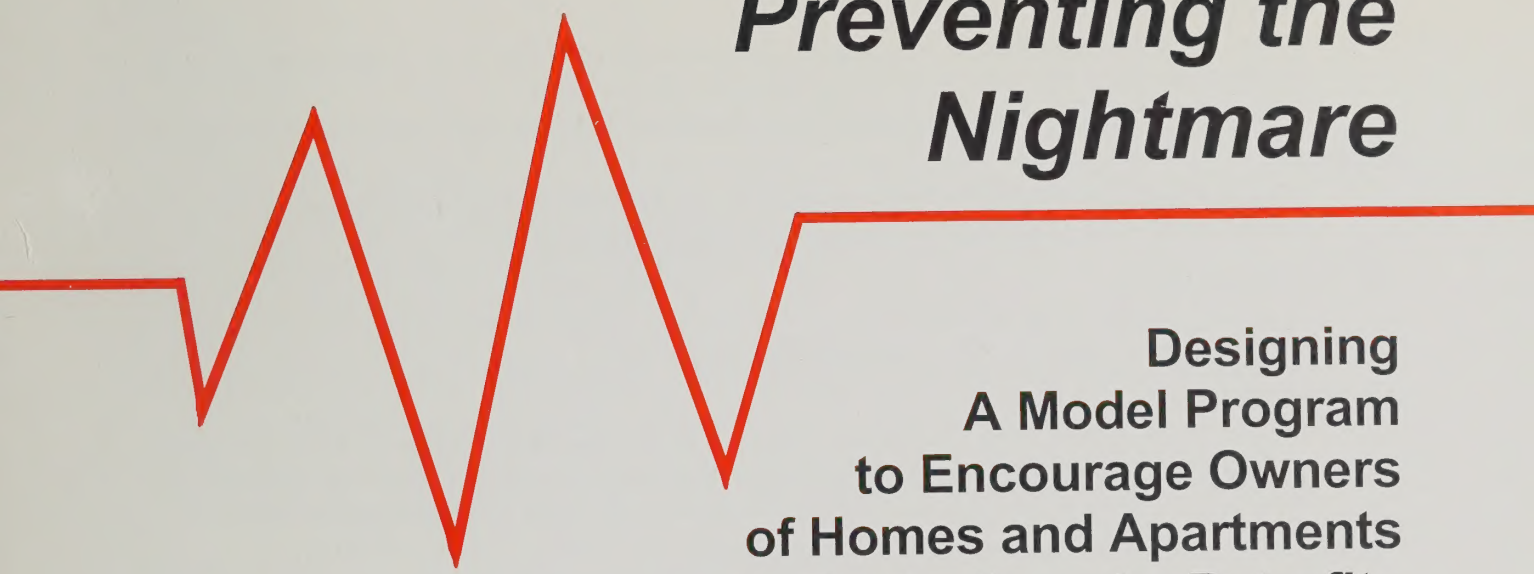
Designing
a Model Program
to Encourage Owners
of Homes and Apartments
to Do Earthquake Retrofits

Complimentary Copy
to our Depository Libraries
ABAG
510/464-7900
www.abag.ca.gov

OCTOBER 1999

ASSOCIATION OF BAY AREA GOVERNMENTS

cover photo credit – courtesy of Charles Meyer, U.S. Geological Survey



Preventing the Nightmare

**Designing
A Model Program
to Encourage Owners
of Homes and Apartments
to Do Earthquake Retrofits**

OCTOBER 1999

ASSOCIATION OF BAY AREA GOVERNMENTS

CREDITS

Report Authors:

Jeanne B. Perkins – Earthquake Program Manager, Association of Bay Area Governments
Kathleen Mikulis – Planner, Association of Bay Area Governments
Brian Kirking – Senior Planner and Analyst, Association of Bay Area Governments

Support:

WOOD-FRAME CONSTRUCTION ANALYSIS – James Russell – Codes Consultant
FAULT MAP CARTOGRAPHY – Eureka Cartography, Berkeley

ABAG Management:

Eugene Y. Leong – Executive Director
Gary Binger – Deputy Executive Director/Planning Director

Acknowledgments:

ABAG would like to thank the several members of the American Society of Home Inspectors (ASHI) for their assistance in collecting data on older homes in the Bay Area. In particular, we would like to thank John Schneider and Toni Wilson from All About Homes for their assistance.

Housing Mitigation and Recovery Review Committee:

Rosemary Corbin – Committee Chair – Mayor, City of Richmond (1999)
James Harberson – Committee Chair – Supervisor, Sonoma County (1997 – 1998)
Shari Adabi – Mitigation Officer, California Earthquake Authority
Pat Buscovich – Structural Engineer, Pat Buscovich and Associates
Arrieta Chakos – Office of the City Manager, Berkeley
Mary Comerio – Professor, Dept. of Architecture, University of California – Berkeley
Donna Curb – Operations Manager, American Red Cross – Bay Area
Jack Harrald – Prof. and Director, Institute for Crisis and Disaster Management, George Washington University
Stephan Kiefer – Building Official, City of Livermore
Laurence Kornfield – Chief Building Inspector, City and County of San Francisco
Nancy Myers – Principal, RE Disclosures
Sarah Nathe – Manager, Disaster Resistance, University of California, Berkeley
Lynn Murphy – California Governor's Office of Emergency Services
Henry Renteria – Emergency Services Manager, City of Oakland
Doug Sandy – Acting Disaster Services Director, American Red Cross – Bay Area
Lee Sapaden / J. Shawn Ortiz – Disaster Response Services Bureau, Calif. Dept. of Social Services
Fred Turner – Structural Engineer, California Seismic Safety Commission
Martha Blair Tyler – Planner, Spangle Associates
Walter Watson / Margaret Montgomery – Earthquake Grants and Loans, California Department of Insurance
Frannie Winslow – Director, Office of Emergency Services, City of San Jose

The writing and production of this report was financed by Grant No. CMS-9705644 from the National Science Foundation (NSF), as well as by the Association of Bay Area Governments. Any opinions, findings, conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the funding agencies.

**For information on ABAG's Earthquake
Program, hazard maps by city, and other
earthquake impacts, see our Internet site at:
<http://quake.abag.ca.gov>**

ABAG Publication Number: P99002EQK

TABLE OF CONTENTS

	page
BACKGROUND	iv
THE PROBLEM – Loma Prieta and Northridge Were a Wake-Up Call	1
The Nightmares	
Our Housing Will Be Decimated	
People Will Need to Be Temporarily Sheltered	
Our Housing Will Need to Be Repaired and Rebuilt	
Problems Vary by Building Type	
Owners Could Be Retrofitting, But Aren't	
A COMPREHENSIVE SOLUTION – We Need Different Approaches for Homes and Apartments	9
Single-Family Homes – A Three-Pronged Approach to Education	9
The Approach	
Risk Perception	
Knowing What to Do	
Money	
Why the Program Must Be Comprehensive	
Multifamily Residential Buildings – The Need for Government Initiatives	11
Apartments and Condos Are a Huge Concern	
Few Owners Retrofit	
More Can Be Done	
PART I – Risk Perception	12
The Importance of an Accurate Perception of the Hazard.....	12
How Do Homeowners Who Retrofit Perceive Their Risk?	
How Can Risk Perception Be Changed?	
When Does Risk Perception Translate into Action?	
Recommendations on How to Incorporate Risk into a City Program	14
Keep the Message Simple	
Use Existing Information	
Personalize the Risk	
Package Risk Information with Action Information	
PART II – Knowing What to Do	16
Existing Programs Focusing on Public Education	16
The Importance of Knowing What to Do	
The City of San Leandro's Training Program	
How We Can Build on San Leandro's Program and Make It Work Better	
Existing Neighborhood Preparedness Programs	
How We Can Build on Neighborhood Awareness Programs and Make Them Work Better	
Recommendations on How to Incorporate Knowledge Transfer Practices	
Into a City Program	18
Keep the Message Simple	
Build on Homeowner "Training" and Stress Completing the Job	
Provide "Friendlier" Business Hours for the Building Department	
Provide Contractor Information	
Encourage Neighborhood Retrofitting	

PART III – Money	20
How Much Does Money Matter?	20
What the Survey of Homeowners Tells Us	
What the Survey of Financial Incentive Programs Tells Us	
The Impact of Insurance	
Recommendations on How to Incorporate Financial Incentives into a City Program	22
Take Advantage of Existing State Programs that Offer Financial Incentives	
Work With Existing Programs Serving Low-Income Households	
Think About Adopting Incentives at the Time of Property Transfer	
PART IV – Making Sure the Program Is Comprehensive	24
Why Do Homeowners Retrofit?	
Does It Communicate the Risk?	
Does It Tell People Specifically What They Need to Do?	
Are There Incentives to Encourage Retrofitting for Low-Income Homeowners?	
ADDITIONAL INFORMATION SOURCES	25

BACKGROUND

This report provides cities and counties in the Bay Area, as well as state and federal agencies, with ideas for developing a comprehensive program to encourage owners to retrofit their houses, condominiums, apartments, and mobile homes.

It is intended to be a follow-up to the “wake-up call” provided by the grim statistics in the ABAG report, *Shaken Awake! – Estimates of Uninhabitable Dwelling Units and Peak Shelter Populations in Future Earthquakes Affecting the San Francisco Bay Region* (Perkins and others, 1996).

The components of that program are described in Parts I, II, and III. The value of the comprehensive approach is described in Part IV.

The conclusions rely on four background research reports which are available together in a separate volume:

- Technical Appendix A* – Analysis of Data from a Survey of Owners of Single-Family Homes
(containing information from 1,755 surveys)
- Technical Appendix B* – Analysis of Data from Home Inspector Survey on Residential
Earthquake Retrofit Rates (containing information from 341 surveys)
- Technical Appendix C* – Existing Government Financial Incentive Programs for Earthquake
Retrofit
- Technical Appendix D* – Analysis of Data from a Survey of Owners of Multifamily
Residential Buildings (containing information from 312 surveys)



The Problem

Loma Prieta and Northridge Were a Wake-Up Call

The Nightmares

In one nightmare, the Hayward fault – extending from San Pablo Bay to the Alameda County–Santa Clara County border – suddenly ruptures, generating a magnitude 7.3 earthquake.

- ◆ Over 155,000 housing units are made uninhabitable.
- ◆ Almost 360,000 people are forced from their homes.
- ◆ Over 110,000 people require publicly-provided shelter.

At the same time –

- ◆ The phone system is overwhelmed.
- ◆ Power outages are widespread.
- ◆ Water and sewer are out of service due to numerous pipe breaks.
- ◆ The transportation system is crippled by over 1,600 road closures.

In another nightmare, the Peninsula-Golden Gate segment of the San Andreas fault – extending from the Santa Cruz Mountains near Hwy. 17 to west of the Golden Gate Bridge – ruptures, generating a magnitude 7.3 earthquake and closing over 800 roads. Fewer homes and apartments are located nearby than in the Hayward earthquake.

- ◆ “Only” 110,000 housing units are made uninhabitable, including 66,000 in San Francisco.
- ◆ Almost 240,000 people are forced from their homes.
- ◆ Over 70,000 people require publicly-provided shelter.

This report is intended to provide information so that cities and counties can develop effective programs encouraging homeowners to retrofit and, thereby, prevent these nightmares. The focus of this report is on structural retrofitting, not on nonstructural measures (which include gas shut-off valves and strapping water heaters to walls).

OUR HOUSING WILL BE DECIMATED

The Number of Uninhabitable Homes Expected Is Huge and Extends Over the Entire Bay Area

The 1989 Loma Prieta earthquake caused a total of over 16,000 units to be uninhabitable throughout the Monterey and San Francisco Bay Areas (including almost 13,000 in the Bay Area). As shown in Table 1 below, *thirteen* of 18 potential Bay Area earthquakes analyzed are expected to have a far larger impact than the Loma Prieta earthquake. In fact, *eight* of these earthquakes will probably have a greater impact than the 1994 Northridge earthquake in the Los Angeles area, where over 46,000 housing units were made uninhabitable. *Many Bay Area faults can generate earthquakes and every Bay Area county is significantly affected by at least two. Several of the larger earthquakes on longer faults will impact several counties.*

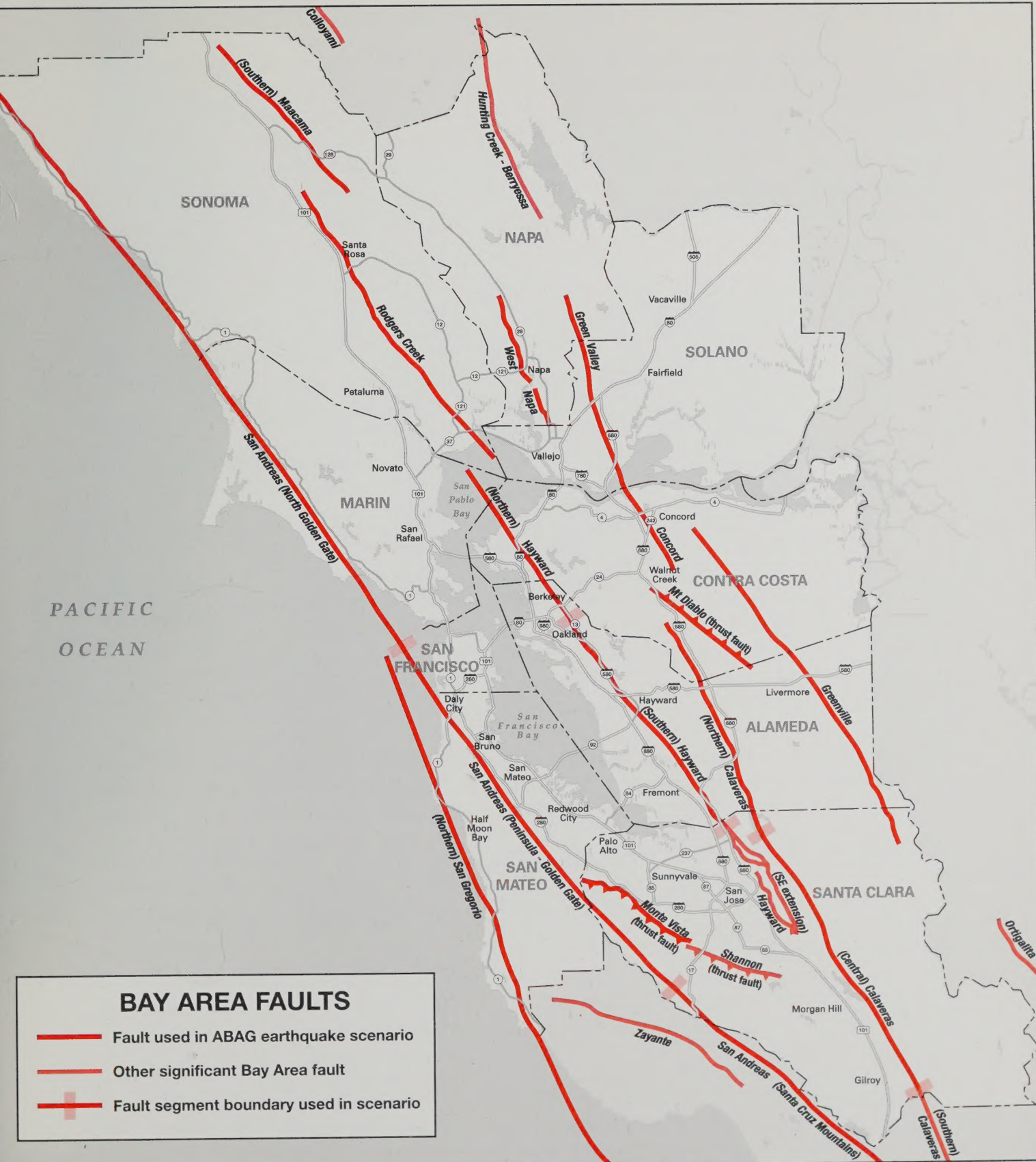
TABLE 1: Predicted Uninhabitable Units for Bay Area Counties and Selected Earthquake Scenarios

Earthquake Scenario	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma	TOTAL
Santa Cruz Mts. San Andreas	1,968	159	297	0	11,781	223	1,277	2	3	15,710
Peninsula-Golden Gate San Andreas	4,243	224	1,516	3	66,094	22,915	15,364	11	43	110,413
Northern Golden Gate San Andreas	3,411	398	2,845	19	59,965	1,178	448	127	1,749	70,140
Entire Bay Area San Andreas	16,048	1,173	3,495	20	82,354	24,472	29,593	185	2,530	159,870
No. San Gregorio	3,104	238	1,176	4	38,306	9,040	589	12	45	52,514
So. Hayward	64,451	1,760	1,030	16	13,940	245	11,892	126	37	93,497
No. Hayward	43,132	7,686	1,653	19	11,464	210	303	128	74	64,669
N + S Hayward	88,265	10,102	2,125	36	37,670	1,616	14,273	1,046	559	155,692
Rodgers Creek	3,688	1,418	1,549	53	11,460	151	100	1,148	13,988	33,555
Rodgers Creek-No. Hayward	49,284	9,786	2,691	713	29,758	363	402	1,386	14,115	108,498
So. Maacama	325	17	27	22	1,986	11	11	15	825	3,239
West Napa	1,382	286	27	4,284	2,011	15	29	1,668	126	9,828
Concord-Green Valley	3,511	11,363	29	1,307	3,191	76	325	2,868	37	22,707
No. Calaveras	7,836	3,509	27	18	3,191	78	4,882	181	6	19,728
Central Calaveras	3,037	75	27	3	3,191	182	10,145	13	4	16,677
Mt. Diablo	6,128	4,868	751	3	10,489	23	109	17	4	22,392
Greenville	3,114	5,175	27	30	2,376	22	258	212	33	11,247
Monte Vista	323	5	16	1	2,429	2,392	27,223	2	2	32,393

TABLE NOTES – This table is based on ABAG's modeling of uninhabitable housing units in future earthquake scenarios (*Shaken Awake!*, Perkins and others, 1996). This modeling is based on an extensive statistical analysis of the housing damage which occurred as a result of the 1989 Loma Prieta and 1994 Northridge earthquakes. However, the expected percentage of pre-1940 single-family homes rendered uninhabitable used to generate this table is larger than published in 1996. New data on lack of retrofitting and reasons for low damage in the Northridge earthquake caused ABAG to increase the uninhabitable percentages used to create this table for pre-1940 single-family homes to 19% and 25% for MMI IX and X, respectively.

Note that several fault segments listed above have new segment end points or were not included in the 1996 report. They are included in this table to reflect ground

shaking information published by USGS in 1999. The Santa Cruz Mts.-San Andreas is similar, but not identical, to the fault causing the Loma Prieta earthquake. The Monte Vista and West Napa faults have been added to the faults analyzed by USGS to illustrate the impact of an earthquake in these areas. The Maacama fault could impact the North Bay, but too little was known about the fault for the USGS to issue probabilities for it in 1999. It, too, has been added to illustrate possible damage. On the other hand, the Southern Calaveras, the Southern San Gregorio, and the northern North Coast-San Andreas faults are outside of the Bay Area. The Bay Area impacts of earthquakes on these fault segments are dwarfed by their Bay Area segments so they are not included. Additional information on earthquakes and housing is available in *Shaken Awake!* and on the ABAG Earthquake Program Internet site at <http://quake.abag.ca.gov>.



PEOPLE WILL NEED TO BE TEMPORARILY SHELTERED

And the Nightmare Doesn't End When the Ground Stops Shaking

During the first three to six weeks following a major earthquake, the American Red Cross, as well as local governments and other organizations, struggle to operate hundreds of emergency shelters for the displaced and to feed many more. Shelters, typically set up for a short period of time, will need to remain open for months, partially because of the Bay Area's low vacancy rate and high occupancy levels. Finding housing is a major challenge in the Bay Area even before an earthquake strikes!

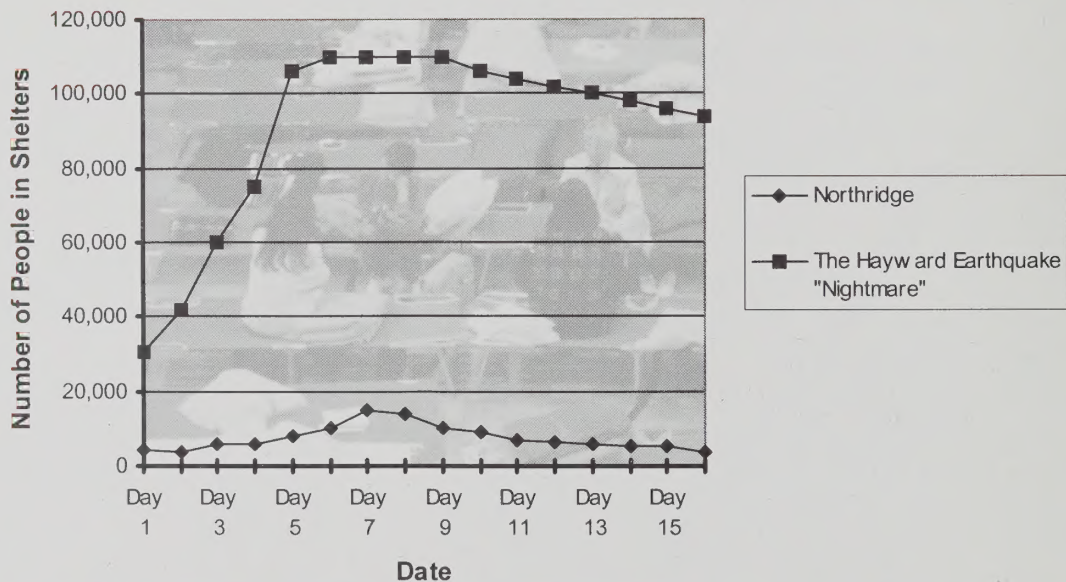


photo source – American Red Cross

The response needs for several of these scenario earthquakes will exceed anything ever experienced in this country. The American Red Cross effort to shelter, feed, and provide emergency assistance after the Northridge earthquake cost \$7.2 million. The cost of the Red Cross effort after Hurricane Andrew was \$13 million. The cost for the Hayward scenario "nightmare" could easily exceed either of these numbers by a factor of ten. The response will stress the resources of government and nongovernment response agencies.

And when these agencies complete their emergency assistance, cities and counties of the impacted area continue to pick up the pieces of intermediate and long-term housing shortages for *years*.

Long-term sheltering can have severe secondary impacts, as well. As illustrated in both southern California after the Northridge earthquake and in Kobe, Japan, the damaged neighborhoods can be socially decimated – with large increases in substance abuse, suicide rates, and violence.

OUR HOUSING WILL NEED TO BE REPAIRED AND REBUILT

The Process Takes Years

The repair, rebuilding and recovery process begins when the ground stops shaking. In general, mobile homes and single-family homes are repaired or rebuilt far more quickly than multifamily housing.

The rate of reconstruction of the housing stock depends on several local factors – incentive, technology, financing, regulation, available space, self help, and luck.

*Prof. Mary Comerio
Professor of Architecture
University of California, Berkeley*

The Bigger the Earthquake, the Longer the Recovery – the Lesson of Mobile Homes

However, the larger the earthquake, the slower the recovery process. Repairs that might be expected to take a few days to a few weeks after a moderate earthquake, can take months or years in a larger earthquake. For example, in the Northridge earthquake, approximately 4,600 mobile homes were either destroyed or so badly damaged that they were uninhabitable. Although the California Housing and Community Development Department staff estimated that it would take “a couple of weeks” for the units to be repaired and habitable, this estimate is not measured from the moment of the earthquake itself. Instead, it is measured from the time a contractor is available to repair a particular mobile home park. After Northridge, the State also made repair funds available to mobile home owners. However, the entire process of reoccupying units in these parks took an entire year.

The 7-Year Recovery of Watsonville

Watsonville, a small town in Santa Cruz County, contained slightly more than 9,900 housing units when the Loma Prieta earthquake struck. The vacancy rate was only 1.7% for rental units. A total of 129 single-family homes, 119 small multifamily buildings containing 431 units, and 266 mobile homes were severely damaged and vacated due to the earthquake, representing 8.34% of the housing stock. The mobile homes were repaired within one month. Approximately 70% of both the single-family and multifamily buildings were repaired within one year. After two years, 96% of the single-family homes, but only 82% of the multifamily buildings, were repaired. The complete recovery took almost seven years!

The Need for Assistance Is Huge – the City of Los Angeles Story

The repair bills for residential buildings damaged by the Northridge earthquake were unprecedented. The estimate of damage to residential buildings was \$12.7 billion. ***Approximately 98% of the rebuilding and repairs had been completed within five years of that earthquake, but not without a large influx of funding.*** A large proportion (approximately \$8 billion) of these losses was covered by earthquake insurance. The City of Los Angeles financed and supported the repair and rehabilitation of over 13,000 housing units with \$314 million in loans. The U.S. Department of Housing and Urban Development provided the City with \$360 million for these loans and other assistance. In addition, HUD provided rental assistance for low-income families displaced. ***It is very unlikely that insurance company and federal government resources and assistance will be adequate for our Bay Area nightmare.***

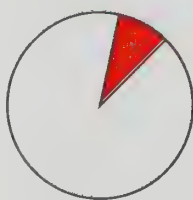
PROBLEMS VARY BY BUILDING TYPE



source – J. Perkins

Single-Family Homes

will be responsible for 9% of the uninhabitable housing units following the Hayward scenario “nightmare.”



source – K. Steinbrugge

Mobile Homes

will be responsible for 7% of the uninhabitable housing units following the Hayward scenario “nightmare.”



Older (usually pre-World War II) houses that are not bolted to their foundations or lack bracing of walls enclosing a crawl space (the cripple wall) accounted for over 2,800 of the 16,000 housing units made uninhabitable by the Loma Prieta earthquake. However, they accounted for only 439 of the 48,000 uninhabitable units resulting from the Northridge earthquake due to (1) the relatively newer housing stock in the San Fernando Valley, (2) the large number of homes built on concrete slab foundations which, therefore, do not have cripple walls, and (3) the large number of homes that had been retrofitted following the 1971 San Fernando earthquake, which impacted much of the same area. ***We will not be as lucky when an earthquake strikes the Bay Area.*** Single-family homes can be heavily damaged even if residents can continue to live in them. Pre-World War II homes are expected to account for over 11,000 of the almost 156,000 uninhabitable housing units following a 7.1 earthquake on the Hayward fault. An additional 2,200 post-World War II homes are also expected to be uninhabitable; homes with living area over a garage, on hillsides, or lacking adequate cripple wall bracing are most vulnerable.

Structural retrofit of older houses typically includes a combination of adding anchor bolts to prevent sliding off their foundations and adding plywood sheathing along portions of the cripple walls to prevent a collapse of those walls. In some cases, a design professional should be consulted because existing foundations need to be strengthened, or because two-or-three-story houses need stronger walls at the sides of garage door openings.

Mobile homes installed prior to 1995 that are not well tied to their foundations are prone to shifting off their supports in damaging earthquakes. Mobile homes accounted for only a couple of hundred of the uninhabitable units resulting from the Loma Prieta earthquake. However, they accounted for almost 4,600 of the uninhabitable units resulting from the Northridge earthquake. Mobile homes are expected to account for over 11,000 of the almost 156,000 uninhabitable units resulting from an earthquake on the entire Hayward fault. These units house a disproportionate share of the elderly and poor, particularly in the North and South Bay.

Three common methods can ensure that mobile homes are structurally safe, that is, that they are properly tied to their foundations (in the order of their effectiveness and cost):

- ◆ Owners can consult a design professional and install a conventional foundation similar to that for a wood-frame home;
- ◆ For new homes or existing homes being relocated, they can install an Engineered Tiedown System using Standard Plan Approvals; or
- ◆ For existing homes, they can install a Certified Earthquake Resisting Bracing System.

Lists of manufacturers for Engineered Tiedown Systems and Certified Earthquake Resisting Bracing Systems are available from the California Dept. of Housing and Community Development. (See the section on ***Additional Information Sources*** at the end of this report.)



source – J. Perkins

Wood-Frame Apartments

will be responsible for 66% of the uninhabitable housing following the Hayward scenario “nightmare.”



Multifamily wood-frame residential buildings, particularly with all or part of the first floor used for parking (“soft-story” buildings) are a huge problem in earthquakes. They were responsible for 7,700 of the 16,000 housing units rendered uninhabitable by the Loma Prieta earthquake and over 34,000 of the housing units rendered uninhabitable by the Northridge earthquake. The potential for deaths in these buildings was driven home when 16 people were killed in the Northridge Meadows apartment complex. Wood-frame multifamily units are expected to account for 103,000 of the projected 156,000 uninhabitable housing units from an earthquake on the entire Hayward fault. These same units also are expected to be the source of a disproportionate share of the public shelter population because they tend to be occupied by people with limited resources – the very poor, the very old, and the very young.

The structural retrofitting for apartments is more complex than for homes. The retrofit should involve a specific solution designed by a structural engineer or other design professional with past experience in this type of work. Retrofitting multi-family buildings with large openings for parking involves adding bracing elements, like steel frames or shear walls at the lowest story level, and tying this bracing into the floor above that level. In taller buildings, some upper story walls may also need strengthening. Because a building’s height, shape and existing construction materials may vary, these factors can require additional retrofit measures to prevent collapse.



source – H. Degenkolb

Unreinforced Masonry Buildings

will be responsible for 8% of the uninhabitable housing following the Hayward scenario “nightmare.”



Unreinforced masonry buildings were responsible for almost 2,000 of the uninhabitable units resulting from the Loma Prieta earthquake, even though they were only 1% of the Bay Area’s housing stock and none of these buildings were subjected to violent shaking (intensity IX or higher) in that earthquake. They accounted for 3,100 of the uninhabitable units resulting from the Northridge earthquake. This number would have been higher except for the aggressive program of the City of Los Angeles to retrofit these structures for life safety. Many of these buildings in other cities still pose a serious life-safety concern. Unreinforced masonry buildings are expected to account for close to 13,000 of the almost 156,000 uninhabitable units resulting from a magnitude 7.1 Hayward fault earthquake. Again, however, these units house a disproportionate share of the poor, particularly in San Francisco.

As with apartment buildings, the retrofit for unreinforced masonry buildings should be designed by a structural engineer or other qualified design professional. Structurally retrofitting unreinforced masonry buildings typically includes bracing parapets and adding anchors at each upper floor level and the roof to keep walls from collapsing. Some buildings may need added sheathing on the roof or floors; in taller buildings, some of the masonry walls may need to be strengthened with spray-applied concrete. Adding steel frames at storefront openings is also a common retrofit method.

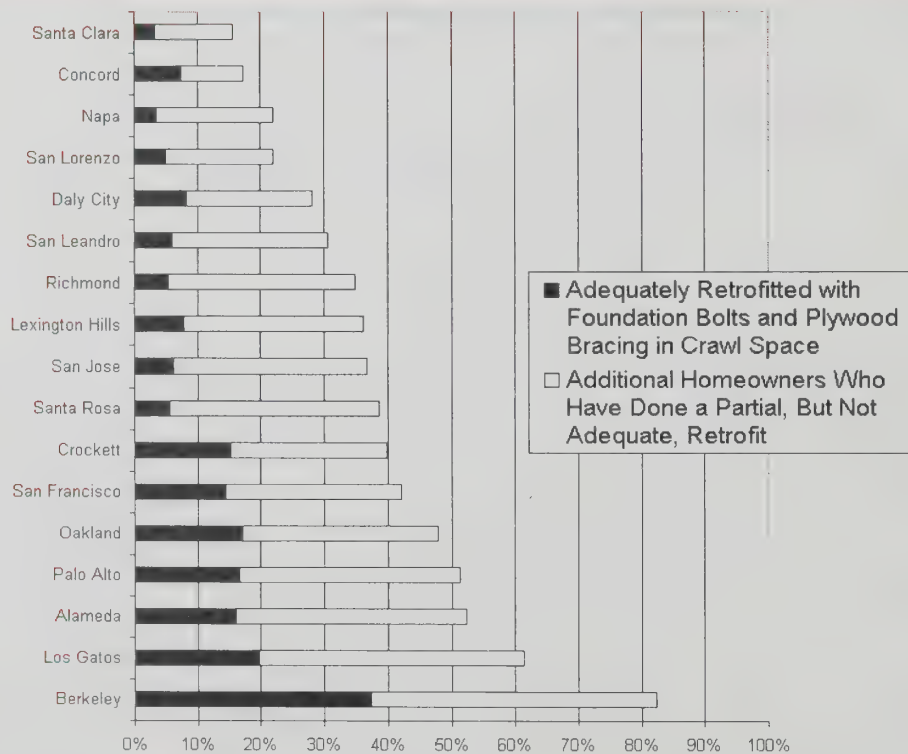
Damage to a variety of other non-wood frame multifamily buildings will be responsible for the remaining 10% of the uninhabitable housing units in the Hayward “nightmare.”

OWNERS COULD BE RETROFITTING, BUT AREN'T

Few Owners of Single-Family Homes Are Retrofitting

Although we can work to be more effective in helping people cope with their losses following an earthquake, it also makes sense to reduce losses. The best way to do this is to retrofit our housing stock so that it is less likely to be damaged to the extent that people must vacate their homes.

Most homeowners are not retrofitting – and those that retrofit are not doing all the work needed to significantly change the likelihood that the homes will be habitable following future earthquakes. This conclusion is based on two sources of information. First, in the summer of 1998, ABAG conducted a survey of single-family homeowners in 17 communities to find out why they were or were not retrofitting. Second, in 1998, we worked with the American Society of Home Inspectors (ASHI) to gather information on retrofit rates for single-family housing in the East Bay.



Retrofit Rates for Single-Family Homes in Selected Bay Area Communities

Fewer Owners of Large Apartment Buildings Are Retrofitting

Retrofit rates for multifamily buildings with more than four units are significantly lower than for single-family homes or small multifamily buildings of 2-4 units. However, the retrofit rate in Berkeley is higher than in neighboring Oakland due, in part, to that City's property transfer tax rebate program which serves as a significant financial incentive for retrofit. These conclusions are based on ABAG's survey of multifamily residential owners in Berkeley and Oakland in the summer of 1999, and data collected on multifamily housing for ABAG by ASHI in 1998.



A Comprehensive Solution

We Need Different Approaches for Homes and Apartments

SINGLE-FAMILY HOMES – A THREE-PRONGED APPROACH TO EDUCATION

The Approach

Our research points to the need for a comprehensive, three-part approach encouraging owners of single-family homes and mobile homes to retrofit.

- (1) Increase their understanding of risk.
- (2) Explain what needs to be done to strengthen their housing.
- (3) Provide financial incentives.

Risk Perception

People act when they understand the consequences of not acting. The correlation between risk perception and action is large. Our survey of homeowners indicates that those who retrofit (versus those who do not) are more likely to:

- ◆ believe that the risk of an earthquake in their neighborhood is very high (versus very low);
- ◆ have seen ABAG's ground shaking hazard maps;
- ◆ have experienced a major damaging earthquake;
- ◆ have lived in the area during the Loma Prieta earthquake;
- ◆ purchase earthquake insurance; and
- ◆ have food and water on hand for several days.

Knowing What to Do

People act when they understand what they need to do. The correlation between knowing what to do and acting is also large. The single most common reason for not retrofitting provided by the homeowners responding to ABAG's survey was "I don't know what I need to do." Interestingly, there is a high correlation between people with a college education and those acting to retrofit their homes. It should not take a college education to understand what to do; the public education program

to encourage a three- to five-day supply of food and water has been effective in reaching people without college degrees. Our message on how and why to retrofit must be targeted to a broader audience.

Money

People act when they believe they can afford to act. Although more people with high incomes are retrofitting than those with low incomes, many existing financial incentive programs for homeowners are currently having a negligible impact on retrofit work. The programs must be accessible and understandable to the low-income populations they are designed to help, rather than for well-informed, higher-income college-educated homeowners.

Why the Program Must Be Comprehensive

People act when they are provided with a consistent message. The higher-than-average percentage of residents who have retrofitted their homes in the City of Berkeley (38%), for example, cannot be attributed to a single factor, but must be viewed as a combination of:

- (1) high risk perception, made credible by City efforts to retrofit city-owned buildings, as well as school district efforts to retrofit school buildings;
- (2) widespread knowledge of what to do, helped by a high education level and the knowledge that one's neighbors have retrofitted; and
- (3) targeted city programs to provide financial incentives.

The following sections describe the reasons for, and details of, each of these program components. None of these approaches, on its own, is nearly as effective as it is when used as part of a comprehensive program.

I can't think of a Bay Area community that wouldn't benefit from strong local programs which encourage retrofitting.

*Rosemary Corbin
Mayor, City of
Richmond*



source – Earthquake Engineering Research Institute (EERI)

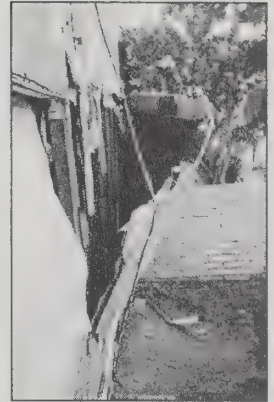
MULTIFAMILY RESIDENTIAL BUILDINGS – THE NEED FOR GOVERNMENT INITIATIVES

Apartments and Condos Are a Large Concern

Few Owners Retrofit

Multifamily residential buildings are projected to account for 84% of the uninhabitable units in the Hayward earthquake “nightmare.”

At the present time, only a small percentage of multifamily residential buildings with five or more units have been retrofitted – even in Berkeley. Existing local government financial incentives are typically limited to buildings housing less than five units. ABAG has financial services programs available for retrofitting larger residential buildings, but these are limited to nonprofit owners.



source: FEMA

In addition, the owners of multifamily buildings see no short-term financial benefits to retrofitting. The costs of retrofitting are difficult to recover with increased rents. Apartment owners also are not responsible for the costs of housing and caring for displaced residents following earthquakes since those costs are borne by federal, state and local governments and by non-profit and community-based agencies, such as the American Red Cross and Salvation Army. In larger buildings, the owner rarely lives in the building and thus does not benefit from the large increases in life safety. In contrast, the potential long-term consequences to the overall economy of the Bay Area are significant.

More Can Be Done

Our efforts should focus on establishing programs similar to those for strengthening unreinforced masonry buildings and applying those programs to soft-story, multifamily residential buildings. Local governments need to:

- (1) inventory soft-story multifamily residential buildings in their community;
- (2) notify the owner and tenants of the potential hazard;
- (3) recommend the owner have an engineering report identifying potential hazards and recommended solutions; and
- (4) encourage retrofitting by, for example:
 - ◆ developing new financial incentives for owners and extending existing incentives for small residential properties to all residential construction, or
 - ◆ establishing disclosure programs.

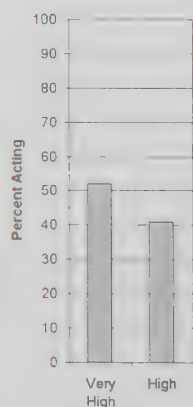
Individual cities could develop these programs and, in fact, several cities in California have beginnings of such programs – Los Angeles has a voluntary retrofit ordinance and San Jose has compiled an excellent guide for apartment owners and has been developing generic retrofit plans. However, we believe it is much more efficient for the California to adopt statewide legislation supporting local governments developing such programs.

Part I

Risk Perception

THE IMPORTANCE OF AN ACCURATE PERCEPTION OF THE HAZARD

How Do Homeowners Who Retrofit Perceive Their Risk?



Many ABAG Survey Participants With a High or Very High Perception of Earthquake Risk Have Acted to Start to Retrofit Their Homes

As stated in the previous section, *people retrofit their homes when they understand the consequences (or risks) of not acting versus the benefits of retrofitting.*

In ABAG's survey of single-family homeowners, we asked several questions related to risk perception, including:

- ◆ Where did you live in 1989 when the Loma Prieta earthquake happened?
- ◆ Have you ever experienced a major damaging earthquake?
- ◆ What do you believe is the risk a major earthquake will affect this home's neighborhood?
- ◆ Have you seen ABAG's earthquake shaking hazard maps for your city?
- ◆ Do you have food and water at your home to help you survive after an earthquake?

Not surprisingly, responses to all of these questions could be correlated with the likelihood that someone acted to retrofit their home. The correlation was greatest for the most direct question – "What do you believe is the risk a major earthquake will affect this home's neighborhood?" Those with a "very high" perception of risk were 22% more likely to have acted to retrofit their homes than those with a "very low" perception of risk.

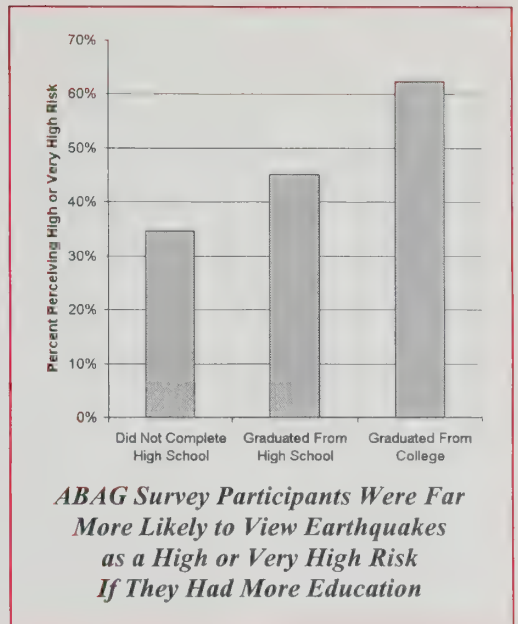
The correlation was also strong in the response to our question on why structural work was undertaken. The two most common responses were those relating to risk:

- ◆ I wanted to feel safer.
- ◆ I am concerned about damaging earthquakes in this home's neighborhood.

How Can Risk Perception Be Changed?

The correlation between education level and earthquake risk perception points to a key issue – our message on earthquake risk must be targeted to a broader audience which includes less well-educated people, as well as those with language barriers.

We can design broadbased education programs. For example, people with significant food and water for emergencies are no more likely to have college degrees than those without these emergency supplies.



Many people may be getting the message that they should be prepared for disasters. But the general preparedness information they are receiving often does not include adequate information on earthquake risks or the benefits of retrofitting homes to reduce potential damage.

When Does Risk Perception Translate into Action?

High risk is not the only factor causing people to retrofit their homes. Our survey (as well as independent information from the American Society of Home Inspectors) indicates that a higher percentage of homeowners have retrofitted in Berkeley than in any other city examined. Risk perception alone is not responsible for this high retrofit rate because homeowners in Alameda, Los Gatos, and Oakland believed homes in their neighborhoods to be at “high” or “very high” risk, yet they did not act to retrofit as often as Berkeley residents. In addition, 25% of those who believed that homes in their neighborhoods were at “very low” risk had acted in some way to retrofit their own home! Thus, *risk information should be “packaged” with retrofit information if we expect risk perception to translate to retrofit action.*

RECOMMENDATIONS ON HOW TO INCORPORATE RISK INTO A CITY PROGRAM

Keep the Message Simple

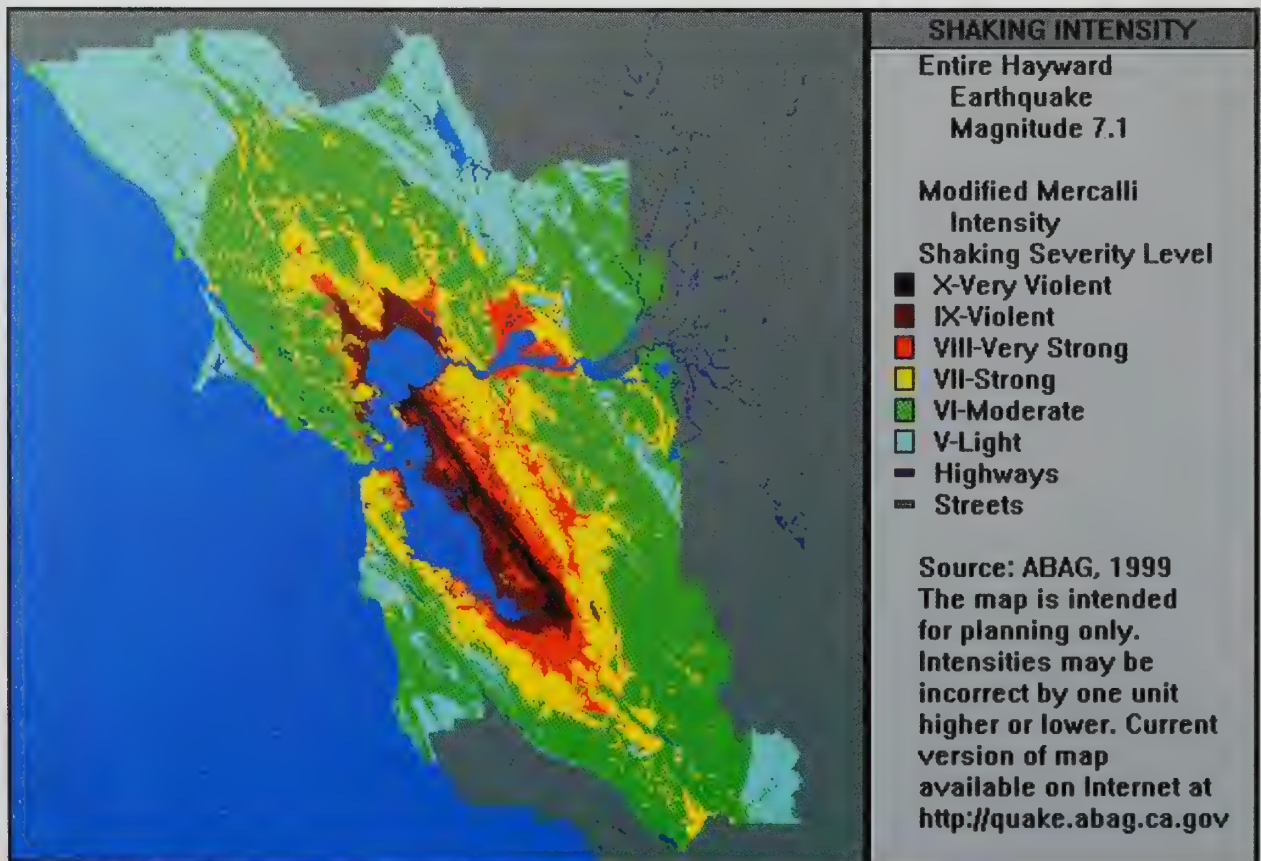
Currently, people with college degrees believe that the risk of a damaging earthquake affecting their home is higher than for people without college degrees. Thus, *risk information needs to be communicated in nontechnical terms.*

Don't expect that shaking hazard maps intended to communicate the hazard to engineers will be appropriate for use in meetings with homeowners. "This area has a 10% probability of exceeding 0.5g in 50 years" is meaningless to a typical homeowner!

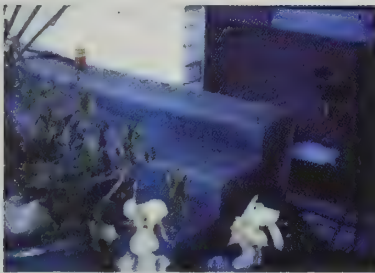
Use Existing Information

This advise does not mean that adequate risk information is not available for use at such meetings. For example, ABAG has issued a number of maps of city areas showing the expected strength of shaking from a number of likely earthquakes. These are available free of charge on the internet at <http://www.abag.ca.gov/bayarea/eqmaps/mapsba.html>.

One such map, depicting the shaking hazard for a magnitude 7.1 earthquake on the entire Hayward fault, is shown below.



Personalize the Risk



source – Coalinga Fire Dept.

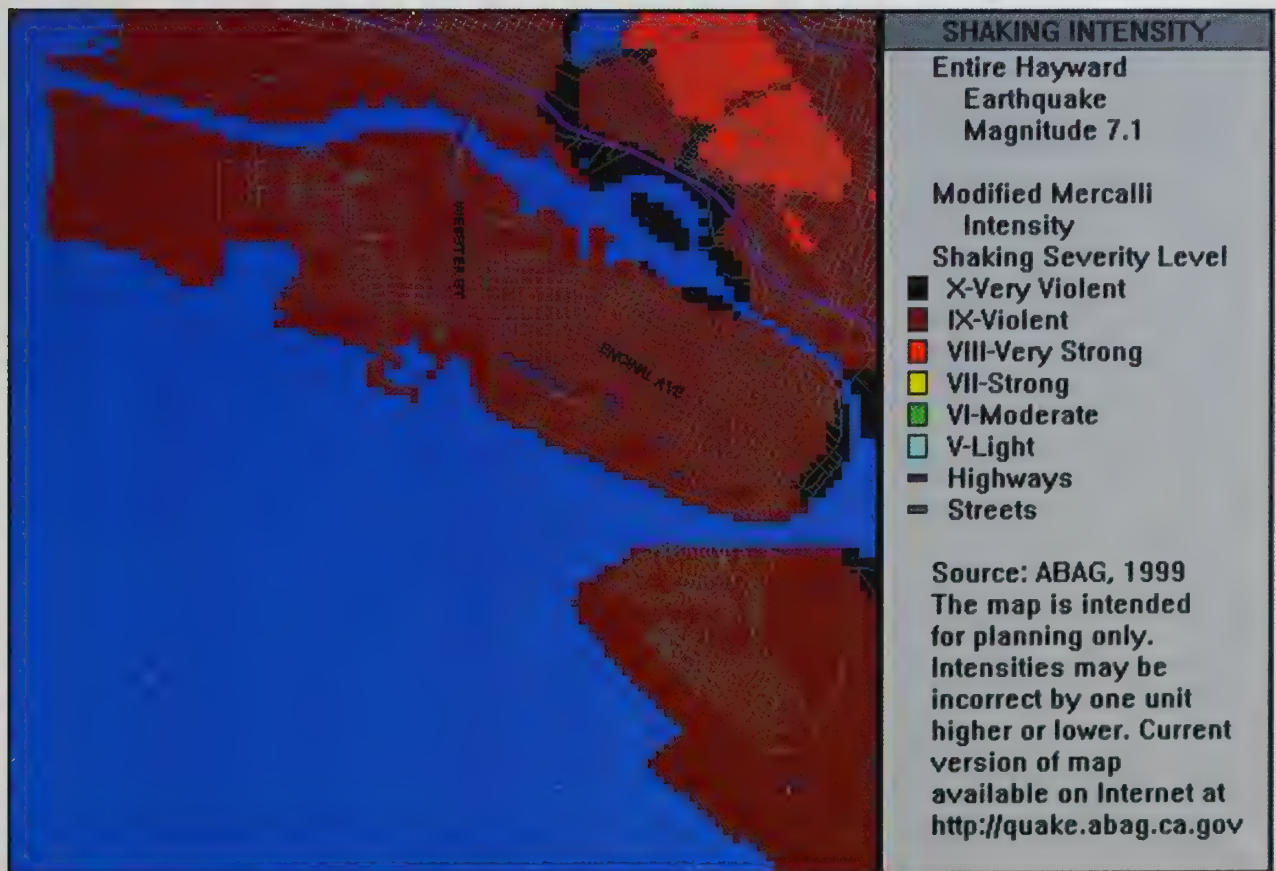
Telling homeowners that the Bay Area is “earthquake country” will probably not be enough of an incentive to cause action. The risk perception is most likely to be acted on if it is personalized; that is, if people are told that the risk is high *in their neighborhood for homes like the one they own*. Thus, it is important to also use city-specific or neighborhood-specific maps, such as the one below for the City of Alameda.

It is also important to explain the risks of damage to a variety of older homes – including Victorians built at the turn of the century, bungalows from the 1920s, and ranch-style homes from the 1950s.

Package Risk Information with Action Information

Risk information alone will not be enough to cause homeowners to retrofit. Therefore it is important that the risk information is packaged with information on what to do about the problem *in the same publication or at the same time*.

The packaging and content of this “action information” are the subjects of the next portion of this report.





Part II

Knowing What to Do

EXISTING PROGRAMS FOCUSING ON PUBLIC EDUCATION

The Importance of Knowing What to Do

The most common reason cited by homeowners for not retrofitting their homes in the ABAG survey (given by 43% of those responding) was “*I don’t know what I need to do.*” Thus, one piece of a comprehensive program to encourage homeowners to retrofit must address this issue.

The City of San Leandro’s Training Program

The City of San Leandro Building Department developed an award-winning program to educate homeowners on how to retrofit their homes. Specifically, the Home Earthquake Strengthening Program contains four basic elements: a set of publications to assist the homeowner in getting underway with a retrofit, a separate inspection and permit for this type of project, a tool-lending “library” for those residents doing the work themselves, and community-sponsored training on how to do the work.

How We Can Build on San Leandro’s Program and Make It Work Better

In spite of this program, homeowners in San Leandro were no more likely to have retrofitted their homes than other areas with equivalent demographic characteristics. We hoped to show that the program increased the likelihood that homeowners who retrofitted would “follow through” and complete all of the work needed; however, this was not the case. Although 31% of San Leandro homeowners have done some retrofit work, only 6% have fully retrofitted their homes. The ratio between these two numbers (5:1) is worse than for most other Bay Area communities studied.

Part of the reason for the relative ineffectiveness of the program is that the homeowner needs to understand the earthquake threat before signing up for the program.

But another potential reason for the relatively low retrofit rate in San Leandro is that the focus of the program is on how to do the work yourself,

not on how to have a contractor do the work. Overall, more than 83% of the homeowners who responded to our survey had hired a contractor to do the work. (Even 82% of those in San Leandro had hired a contractor.) The knowledge that most homeowners are seeking probably is more concerned with what work needs to be done, how to obtain a building permit, how to select a contractor, and how much (typically) the work will cost. The specific “hands-on” construction training offered by the city is not as valuable if the homeowner is not doing the work themselves.

Finally, homeowners who start the retrofit process by doing the work themselves may discover that doing the job correctly is more complex than anticipated. In many instances, an older home may have unique characteristics that make it difficult to apply standard recommendations.



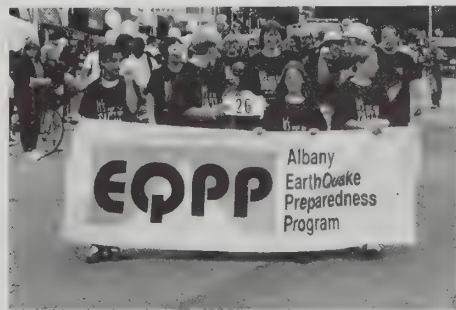
source – City of San Leandro

Sometimes I feel like a dentist who tells a patient they need a root canal when their tooth doesn't hurt. We need to make the process painless.

Pat Buscovich
Structural Engineer

Existing Neighborhood Preparedness Programs

Another set of programs offered by dozens of Bay Area cities focuses on neighborhood preparedness. The programs typically work to improve capabilities to respond after the earthquake has occurred, focusing on first aid and disaster triage, communications, and sheltering. Few emphasize structural mitigation, such as bolting and shearwall installation techniques.



source – City of Albany

We have to celebrate being prepared. If we don't, people won't act.

Frannie Winslow
Director of Emergency Services
City of San Jose

How We Can Build on Neighborhood Awareness Programs and Make Them Work Better

Based on our homeowner survey, knowing someone who has retrofitted (such a friend or neighbor) increases the likelihood that the person has retrofitted by over 23%! Focusing on neighborhoods should be a key component of telling homeowners of their risk and what to do to retrofit their homes. Thus, *neighborhood preparedness programs should “package” risk and emergency response information with information on how to bolt your home and install shear walls!*

RECOMMENDATIONS ON HOW TO INCORPORATE KNOWLEDGE TRANSFER PRACTICES INTO A CITY PROGRAM

Keep the Message Simple

People need basic information on what needs to be done to make their homes safer. Most will be hiring a contractor to do the work, not doing the work themselves. Thus, the “job” for the typical homeowner is not knowing how many bolts and how much plywood to install and where, but rather:

- ◆ knowing what retrofit work is critical and most cost effective;
- ◆ knowing how to select a licensed contractor;
- ◆ specifying to contractors what work needs to occur (through use of prescriptive standards or an engineer);
- ◆ ensuring that the contractor obtains a building permit; and,
- ◆ thereby, ensuring that the contractor’s work is inspected.

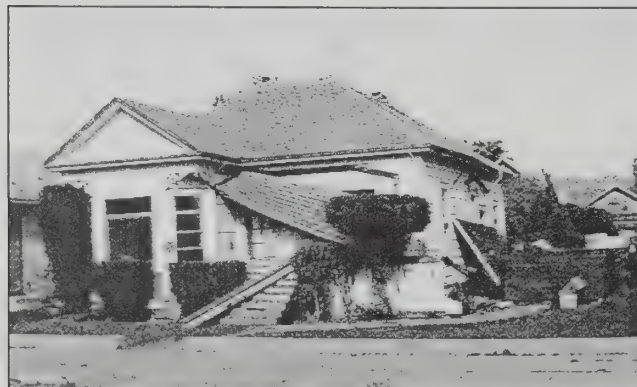
Build on Homeowner “Training” and Stress Completing the Job

This basic information does not mean that there is not a need for training some homeowners on how to do the work themselves. Rather, we see a larger need to provide basic training on what to do for a much broader audience. The broader training needs to cover the major causes of damage and to stress addressing all of the reasons for most earthquake damage – including lack of bolts, lack of plywood sheathing, and weak garage door openings. As with the San Leandro program, the model program needs to emphasize that all potential problems should be addressed when retrofitting.

Cities and counties encouraging homeowners to do the work themselves need to:

- ◆ provide access to training in the city (or in a neighboring city), and
- ◆ provide access to a building inspector to advise them on how to identify areas where “standard” designs may not work before the actual retrofit has started.

Communities also need to offer pre-inspections for homeowners doing the work themselves, in addition to the inspections following the installation of bolts and following the installation of plywood.



*source — Anthony D.
Moscole and Associates*

***Provide
“Friendlier”
Business Hours
for the Building
Department***

It is important for homeowners to obtain building permits for earthquake retrofitting work. The building permit protects the homeowner through the inspection process and provides a record showing that work was done in accordance with accepted standards and local codes.

The process of obtaining the permit can be intimidating for a typical homeowner, particularly those with job hours that are inflexible or who live some distance from the local building department. Homeowners in unincorporated areas and in San Francisco were more likely to state that they had not retrofitted their homes because “I was afraid or intimidated by the City or County, such as the building or planning department.” Therefore, local governments, particularly counties and larger cities, need to consider having evening and weekend hours, as well as “special” mini-city halls set up in conjunction with preparedness fairs in outlying areas.

***Provide
Contractor and
Engineer
Information***

Finding a reputable and knowledgeable contractor can also be an intimidating process for some homeowners. They also need to know when they should contact an engineer. Information is available from a variety of sources. For example, San Leandro provides a list of contractors who have received training from their building department. ABAG has worked with the Federal Emergency Management Agency (FEMA) to provide training for contractors and building inspectors on how to retrofit homes. ABAG has also worked with the Structural Engineer’s Association of Northern California to develop lists of engineers with experience in home retrofits. These listings can easily be customized for local areas. Both are available on ABAG’s internet site at:

<http://www.abag.ca.gov/bayarea/eqmaps/fixit/fixit.html>.

Note that contractors' liability coverage, workers' compensation insurance, and licenses were verified at the time of training; however, homeowners should check with the contractor to see if these are still valid. You can also call 1 (800) 321-CSLB to verify that a contractor's license is valid.

When to Call an Engineer – Not Just a Contractor – About Your Home

☒ your home has two or more stories	☒ your home has a two-car or larger garage with rooms above it, or is a “split-level”
☒ part of your home is supported by posts, not a wall	☒ your home has a porch that is recessed under a second story
☒ your foundation is brick or is “weak”	☒ your home is currently not “level” or has settled
☒ your home is on a steep hill	☒ your home is almost touching an adjacent home
☒ your home has an unusual shape, is very long and narrow, or is shaped like an “L”	

***Encourage
Neighborhood
Retrofitting***

Although few homeowners surveyed listed “knowing someone who has retrofitted” as one of the reasons for retrofitting, having a friend or neighbor who has retrofitted definitely improves the chances of knowing what needs to be done. Homeowners can be intimidated by the process of retrofitting, and knowledge on specific contractors their neighbors used, as well as specific costs of retrofitting a similar home, should alleviate those fears. Thus, retrofit programs should target individual neighborhoods to maximize this “snowball” effect.



Part III

Money

HOW MUCH DOES MONEY MATTER?

What the Survey of Homeowners Tells Us

Homeowners believe cost is a significant factor preventing retrofits. Over one-third (37.8%) of the those responding to the ABAG survey said that they had not done structural retrofitting for their homes because “I think it costs too much for me to do.” This reason was the second most popular in the list after “I don’t know what I need to do.” In addition, income was the second best predictor of whether or not someone had acted to structurally retrofit their home (after whether or not they knew someone who has acted). Thus, cost might appear to be a major factor preventing retrofitting.

However, on closer examination, cost is not a major factor preventing retrofits. We examined the household incomes of those listing cost as a reason for not retrofitting versus those not retrofitting, in general. Among these homeowners, the cost factor was only significantly larger among homeowners with household incomes of less than \$20,000 a year.

Thus, the issue is not so much actual cost or affordability as the perception that retrofitting is costly or too costly to be a priority.

What the Survey of Financial Incentive Programs Tells Us

ABAG staff reviewed eight existing government financial incentive programs intended to encourage earthquake retrofit work. All three California Department of Insurance and California Earthquake Authority programs were responsible for no more than 9 Bay Area retrofits in 1998. The City of Los Angeles’s program was responsible for only 12 retrofits in 1998. The City of Oakland’s program may be responsible for up to 27 retrofits in 1998. Yet the City of Berkeley has waived permit fees for 4,073 projects and has provided partial funding through property transfer tax rebates for 6,341 property owners between 1992 and early 1999.

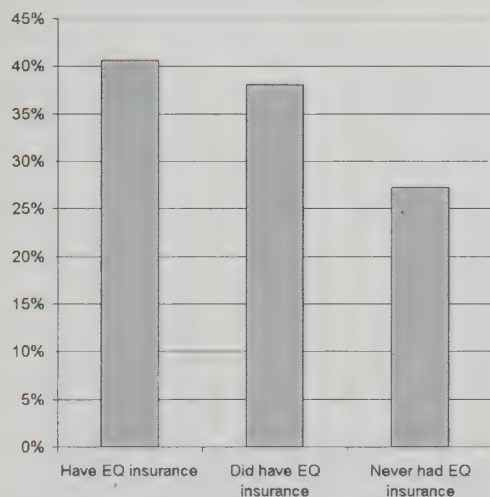
Berkeley's programs are being used, and Berkeley residents are retrofitting at a higher rate than anywhere else examined in the Bay Area. Our surveys of owners of residential buildings indicate that the Berkeley property transfer tax rebate program was a major incentive for 15% of the single-family retrofits and 43% of the multifamily retrofits which have occurred in that community since 1991. This conclusion is confirmed by the high percentage of homeowners

retrofitting within one year after they purchase their residential building, enabling them to claim this rebate. (The percentage of single-family owners retrofitting who do so within one year, and thus are able to claim this rebate, increased from 24% prior to 1991 to 50% after 1991. The percentage of 2-4 unit multifamily owners retrofitting who do so within one year increased from 43% prior to 1991 to 70% after 1991.)

The Impact of Insurance

For a number of years, insurance companies have complained about having to write policies to cover earthquake losses in California. Eventually, the "insurance crisis" led to State legislation mandating that any company offering property insurance to homeowners also had to offer earthquake coverage. In 1994, these companies were impacted by losses in the Northridge earthquake.

Subsequent threats by insurance companies to drop all property insurance in California led the State legislature to change the legislation mandating earthquake coverage to allow insurers to offer coverage from the California Earthquake Authority (CEA). The CEA was established as a quasi-public agency regulated as a private insurer by the California Department of Insurance, but publicly managed by a five-member Governing Board consisting of the Governor, the Treasurer, the Insurance Commissioner, the Senate President pro Tempore, and the Assembly Speaker. The CEA's mandate is not to offer "reasonable" rates, to encourage retrofitting, or even to sell insurance, but rather to offer coverage to homeowners who choose to purchase it.



Percentage of Homeowners Responding to ABAG's Survey Who Have Performed Complete Structural Retrofits Versus Earthquake Insurance Coverage

The standard economic models would say that insurance is a "risk transfer" mechanism; that is, homeowners should be less likely to retrofit their homes if they purchase earthquake insurance than if they do not. In addition, many earthquake researchers were told of individuals who had dropped their earthquake coverage due to increases in premium costs, choosing instead to perform retrofit work. Thus, it made sense to expect that the CEA's rates were encouraging fewer homeowners to purchase insurance and more homeowners to retrofit.

Our survey of homeowners shows the opposite to be the case, as shown by this graph. ***Thus, the availability of earthquake insurance from the CEA cannot be blamed for discouraging retrofitting, and its high rates cannot be given credit for encouraging retrofitting.***

RECOMMENDATIONS ON HOW TO INCORPORATE FINANCIAL INCENTIVES INTO A CITY PROGRAM

Take Advantage of Existing State Programs that Offer Financial Incentives

The existing state programs offering financial incentives through low-interest loans available for residential properties are adequate financial incentives for most homeowners. However, these programs are being underutilized. The CEA and Department of Insurance need to work with cities to better publicize the programs to those thinking about retrofitting. Thus, information on these programs should be a part of any literature developed by cities to encourage retrofitting. There is little need for cities to develop similar low-interest rate programs. Information on these programs is currently available on ABAG's web site at:

<http://www.abag.ca.gov/bayarea/eqmaps/fixit/money.html>.

Work with Existing Programs Serving Low-Income Households

Homeowners with the greatest need for financial incentives are those with household incomes of less than \$20,000 per year. Yet these homeowners are least able to deal with the complex requirements of typical financial incentive programs. While only 20% of low-income homeowners responding to the ABAG homeowner survey had graduated from college, 67% of the total respondents had college degrees. The programs designed for low-income homeowners must, therefore, be nontechnical and easily understood.

It is probably more effective to use existing programs serving low-income populations, such as *Christmas in April* and *Habitat for Humanity*, to reach the low-income homeowners than to set up separate programs offering grants to them. Interestingly, the City of Berkeley provides funds to *Christmas in April* each year to help such homeowners, even though this policy was not felt to be a significant part of their program!

Think About Adopting Incentives at the Time of Property Transfer

Berkeley's property transfer tax rebate program was adopted by the City Council prior to the passage of California's Proposition 218 which would have required that the program be passed by a two-thirds majority of the voters. Thus, there would be either significant political capital involved in adopting a city-wide tax increase, or significant expenditures of city revenues, for another city to adopt a financial incentive based on a property transfer tax increase.

Financial incentive programs could be targeted to have the largest impact on those with the lowest incomes. Thus, the Berkeley program could be downsized and used by other cities at significantly lower costs if the program were limited to low-income homeowners.

Think About State and Federal Financial Incentives

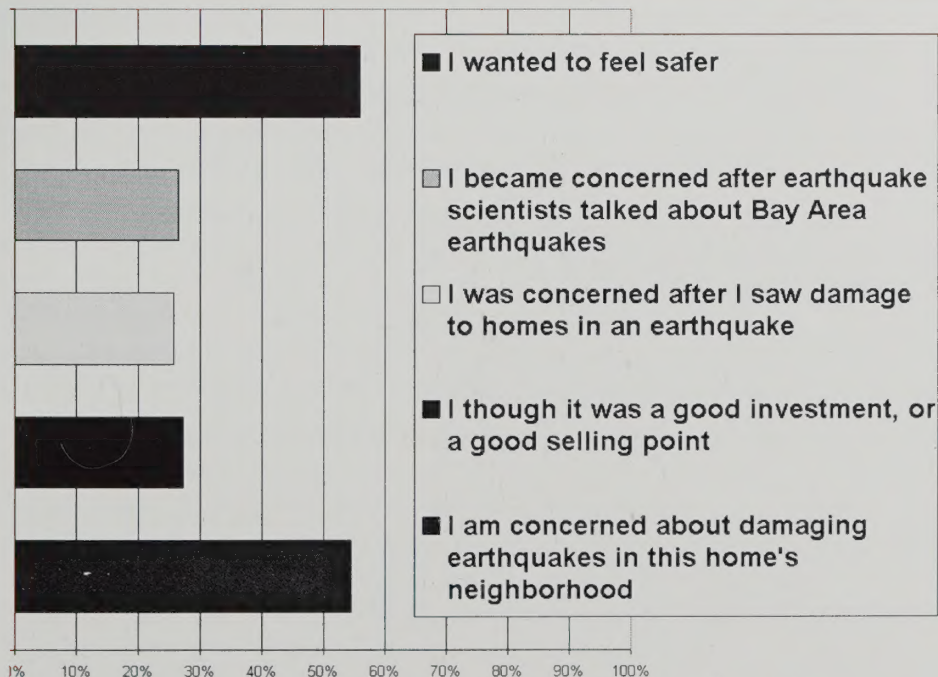
Finally, possible financial incentives provided by state or federal governments should also be considered to encourage retrofitting. The only existing state tax incentive for retrofitting is that there is no increase in property taxes for this type of home improvement.

Part IV

Making Sure the Program Is Comprehensive

Why Do Homeowners Retrofit?

Homeowners, when provided with a list of 13 reasons for why they might have retrofitted, gave an average of 2 to 3 responses. Thus, they retrofit when provided with a variety of reasons for retrofitting, and when the obstacles for not retrofitting are reduced or eliminated. Thus, as cities and counties work to encourage retrofitting, it is important to make sure that the program is comprehensive.



Principal Reasons Why Bay Area Homeowners Have Retrofitted Their Homes

As cities and counties review existing programs for encouraging retrofitting, it is important that they remember to incorporate the three components of success described in this guide:

- (1) communicating the risk;
- (2) explaining to owners what needs to be done – not only the “nuts and bolts,” but also the process; and
- (3) providing financial incentives and assistance.

All of these components must be packaged together.

***Does It
Communicate
the Risk?***

Everyone should be able to understand the risk to their own home in an earthquake. The Bay Area is cracked by numerous active faults; faults have formed most of the major valleys – the same valleys where urban development is concentrated. ***People need to be told that the risk is high in their neighborhood and for the type of home which they own.***

***Does It Tell
People
Specifically
What They
Need to Do?***

The information on how to retrofit your home should be expanded. We need to build on neighborhood preparedness programs and provide information for both for those who will be doing the work themselves ***and*** those who will be hiring a contractor. People need to know when to hire an engineer ***and*** when one is probably not required. ***We need to keep the process painless and to celebrate our successes!***

***Are There Ways
of Encouraging
Retrofitting for
Low Income
Homeowners?***

The group of homeowners with the greatest need for financial incentives are those with household incomes of less than \$20,000 per year. Yet these homeowners are least able to deal with the complex requirements of typical financial incentive programs. Working with existing programs, such as ***Christmas in April***, may be more effective than setting up local grant programs with complex requirements. The existing grant program of the California Department of Insurance should also be better publicized.

***Housing damage was responsible
for HALF of the dollar loss in the
Northridge earthquake.***

*Mary Comerio
Professor of Architecture
University of California, Berkeley*

ADDITIONAL INFORMATION SOURCES

From the Association of Bay Area Governments

ABAG offers a number of publications related to assisting local governments in planning for and recovering from damage following earthquakes. Three relate to housing (in addition to this publication) and can be obtained from ABAG at P.O. Box 2050, Oakland, CA 94604, or by phone at 510/464-7900.

- (1) *Stand Up to the Quake – Get Your Home in Shape* (1999 video - \$7 + \$3 postage + tax)
- (2) *Preventing the Nightmare – Four Technical Appendices* (1999 report - \$20 + \$5 postage + tax)
- (3) *Shaken Awake! Estimates of Uninhabitable Dwelling Units and Peak Shelter Populations in Future Earthquakes Affecting the San Francisco Bay Region* (1996 report - \$15 + \$5 postage + tax)

In addition, ABAG offers extensive **free** earthquake information on our Internet site at <http://quake.abag.ca.gov>, including:

- (1) Maps showing predicted severity of shaking by fault and by city (click on the “On Shaky Ground” button)
- (2) Lists of contractors who have taken our training to do structural retrofitting work, a list of home inspections that we have trained, and a list of structural engineers with retrofit experience (click on the “Mitigation” button)
- (3) Standard ways to fix both structural and nonstructural problems, including strapping water heaters (click on the “Mitigation” button)
- (4) Sources of money to help pay for retrofitting homes (click on the “Mitigation” button)

From the California Governor’s Office of Emergency Services (OES) Coastal Region Resource Center

OES offers two publications and a video on strengthening wood-frame homes:

- (1) *An Ounce of Prevention: Strengthening Your Wood Frame House for Earthquake Safety*
 - ◆ Construction Guide (1993)
 - ◆ Video (1992)
- (2) *A Guide to Strengthening and Repairing Your Home* (1995)

OES has a variety of publications and audio-visual emergency preparedness materials about various subjects, including but not limited to home and family, schools, and businesses. To borrow a video or request free publications, phone the resource center at 510/286-0869.

From the California Seismic Safety Commission

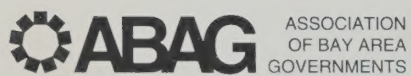
The Commission has a general guide on how to identify typical earthquake weaknesses in your home. Home sellers are required by state laws to disclose these weaknesses to home buyers – *The Homeowners Guide to Earthquake Safety*, 1997. (SSC Report 97-01, 28 pages.) To obtain a copy, contact your Realtor, local Board of Realtors, or the Commission at 1755 Creekside Oaks Drive, Suite 100, Sacramento, CA 95833, or phone 916/263-5506. The cost is \$3.25.

From the California Department of Housing and Community Development (HCD), Division of Codes and Standards

HCD has free lists of HCD-certified manufacturers of:

- ◆ Engineered Tiedown Systems using Standard Plan Approvals for new or relocated mobile homes
- ◆ Certified Earthquake Resisting Bracing for existing mobile homes.

Contact HCD at 8911 Folsom Blvd., Sacramento, CA 95826, or phone 916/255-2501.



MetroCenter
Eighth & Oak Streets
Oakland
(510) 464-7900

Mailing Address:
P.O. Box 2050
Oakland, CA 94604-2050

